UNIVERSITI TEKNOLOGI MARA

STRUCTURAL BEHAVIOUR OF REINFORCED EXPANDED POLYSTYRENE STEEL FIBRE LIGHTWEIGHT CONCRETE (EPSF-LWC) WALL PANEL WITH OPENING UNDER AXIAL LOAD

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Thesis submitted in fulfillment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Civil Engineering

August 2018

CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 3rd August 2017 to conduct the final examination of Jamilah binti Abd.Rahim on her Doctor of Philosophy thesis entitled "Structural Behaviour of Reinforced Lightweight Concrete (EPSF-LWC) Wall Panel with Opening under Axial Load" in accordance with Teknologi MARA act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

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I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non- academic institution for any degree of qualification.

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ABSTRACT

This study was conducted to determine characterization of lightweight concrete (LWC) mix containing expanded polystyrene (EPS) beads and reinforced with steel fibre. In the mix design calculation, the percentages of EPS beads added to the mix differ while the percentage of steel fibre were remained. The concrete mix were divided into three series which were series A, series B and series C. Each series represented different percentage of EPS and steel fibre. Series A (M1) had zero EPS and zero steel fibre. Series B, contained 10 % (M2), 20 % (M3), 30 % (M4) and 40 % (M5) of EPS and zero steel fibre. Series C contained 10 % (M6), 20 % (M7), 30 % (M8) and 40 % (M9) of EPS enhanced with 0.5 % of steel fibre. Then, the bonding strength between expanded polystyrene enhanced with steel fibre lightweight concrete and reinforcement rod were evaluated. The results showed compressive strength EPSF-LWC of mix proportion M8 in series C were 19.51 MPa with density 1939 kg/m^3. It is greater than 17 MPa as the requirement for structure component application as stated in the ASTM C-300. The bonding stress of mix 1 (M1) in series A was 531.22 kPa and deformation was 5.83 mm. Meanwhile, bonding stress and deformation of reinforcement embedded in the mix 4 (M4) series B, were 174.54 kPa and 2.63 mm, respctively. Bonding stress and deformation in Mix 8 (M8) series C were 110.84 kPa and 1.5 mm, respctively. The deformation of the reinforcement rod embedded in the concrete influenced by the bonding stress of the concrete. From all concrete mix M1 to M9, only M8 from series C was chosen to be applied in the construction of EPSF-LWC wall panel. Hence, thirty two (32) of reinforced and unreinforced EPSF-LWC wall panels with different opening configuration and size were constructed to study the EPSF-LWC wall panel behaviour. The wall was set up under pinned-pinned (PP) and pinned-fixed (PF) end support conditions. The structural carrying capacities of EPSF-LWC wall panels with and without openings were compared. There were sixteen (16) samples with different cases modelled using finite element analysis (FEA) to validate the maximum loading, lateral displacement and crack patterns obtained from experiment and FEA. The maximum load carrying capacity for EPSF-LWC wall with opening obtained from reinforced (WR1) and unreinforced (WUR1) samples were 616.60 kN and 771.10 kN, respectively. Meanwhile, for reinforced and unreinforced EPSF-LWC wall panels without opening designated as WR2, WR3, WR4 and WUR2, WUR3, WUR4, respectively recorded the load carrying capacities of 315.10 kN, 350.20 kN, 331.80 kN, and 341.90, 470.70 kN, 430.50 kN respectively. The locations and sizes of openings in wall system have significant relationship to determine the wall capacity. Openings have significant effects on the strength capacity due to the high stress concentration. The deformation profile for experimental and finite element analysis (FEA) showed similar trends which linearly increased with maximum lateral displacement. It shows a single curvature pattern. Most of the cracks occurred at the opening edge and then followed by crushing at the top and bottom of wall panels. As conclusion the EPSF-LWC wall panels can sustain the axial load applied. The research is also showing a valuable insight in the actual process for the EPSF-LWC when it is applied to wall panel with opening subjected to axial compression load.

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